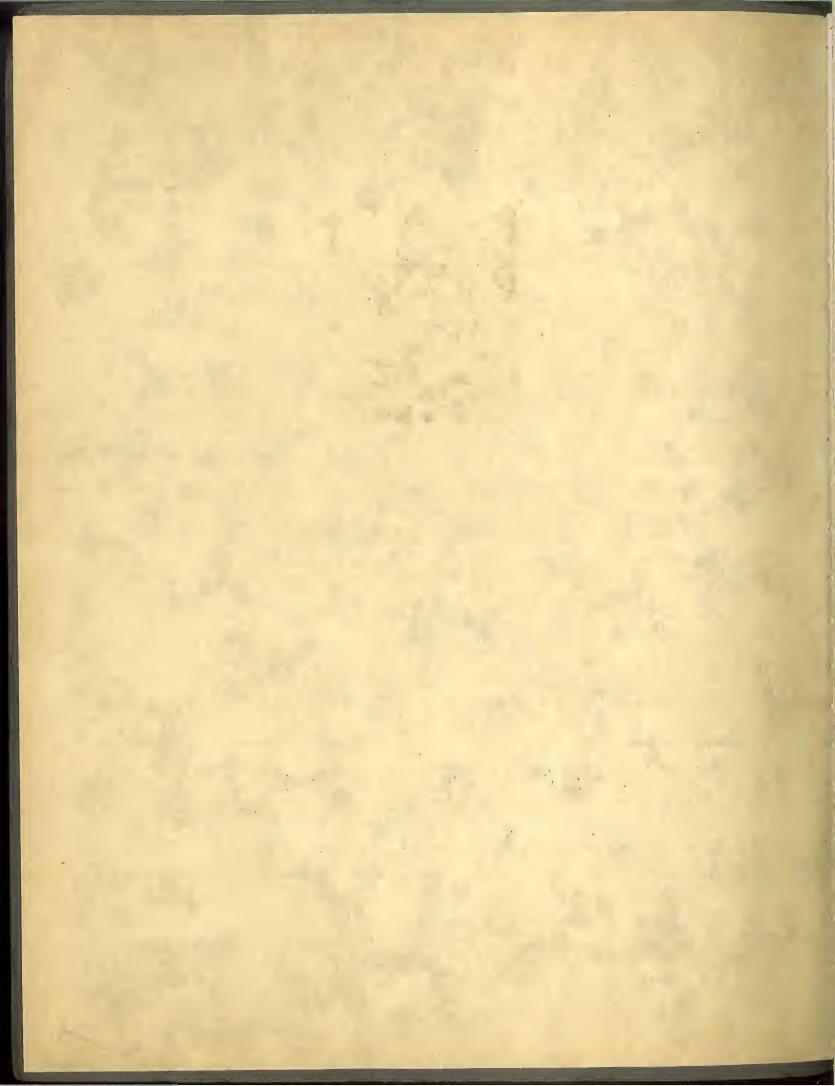
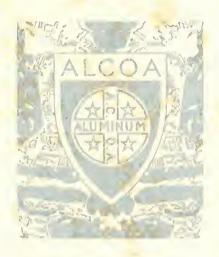


## \* \* LABORATORIES \* \*





## ALUMINUM RESEARCH LABORATORIES



FRONT VIEW OF ALUMINUM RESEARCH LABORATORIES

ALUMINUM RESEARCH LABORATORIES invite you to inspect their new home. From the days when the research staff consisted of Charles M. Hall, the research work of Aluminum Company of America has constantly expanded. Founded on research and developed by research, the aluminum industry has consistently applied new scientific methods and discoveries to the commercial development of aluminum. The new laboratory, located at New Kensington, houses a staff of one hundred and fifty, while small staffs are maintained at five other plants of the Company.

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(Page 2)

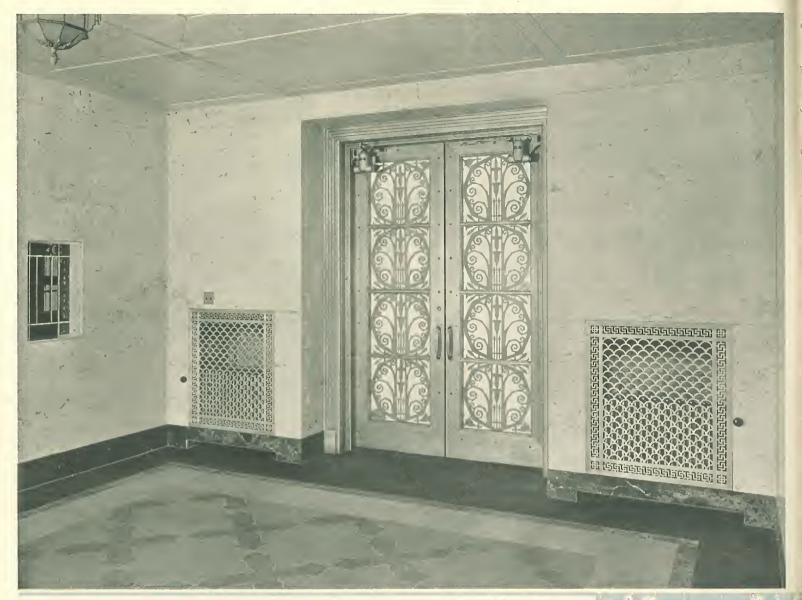


ENTRANCE TO ALUMINUM RESEARCH LABORATORIES

In order to provide an atmosphere conducive to scientific work, the new laboratory has been built on a 14-acre tract, surrounded by lawns and shrubbery, overlooking the Allegheny River and amidst the foothills of the Allegheny Mountains. The architects have designed a practical laboratory with classic lines.

The exterior of the building demonstrates some of the uses which are being made of aluminum in architectural decoration and construction. Approaching the main entrance, the eye is attracted by the aluminum doors

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ENTRANCE LOBBY EXECUTED IN MARBLE WITH ALUMINUM

DOORS AND FIXTURES

with their cast aluminum grille work, framed by aluminum castings enameled in blue, green, white and red. Between the limestone pilasters, aluminum window frames are set with aluminum mullions and separated between floors by cast aluminum spandrels, decorated with blue and green vitreous enamel. Surmounting the building is a decorative aluminum cornice.

Entering the lobby, one is struck by the color harmony of aluminum fixtures against white marble walls. The inlaid aluminum design in the green and white terrazzo floor harmonizes with the chandelier, radiator grille

(Page 4)



ALUMINUM FURNITURE IN THE CONFERENCE ROOM
PANELED IN OAK

work, and elevator doors shown on page 26. The same motif employed in the design of the chandelier in the lobby is used in the lighting fixtures for the Conference Room, which is on the same floor. This room, paneled in oak, natural finish, provides a meeting place for staff conferences and groups of visitors to the laboratory. The blue upholstery provides a striking contrast with the natural finish of the aluminum furniture, which is also set off by the deep blue background of the rug. Aluminum chairs, light, durable, and fireproof, are used in offices and laboratories.



VIEW OF ELECTRIC MELTING AND ROLLING EQUIPMENT IN
METALLURGICAL LABORATORY

RESEARCH in the metallurgy of aluminum and its alloys is one of the principal activities of the laboratories. Equipment for experimental melting, casting and rolling of aluminum alloys is located in large laboratories on the ground floor. A commercial size rolling mill is also operated in a building located at the New Kensington plant.

Heat treatment is becoming increasingly important with the advent of the strong aluminum alloys, and a variety of types of electrically-heated furnaces are provided for this purpose. The metallographic investigation of



( Page 6 )



ELECTRIC FURNACES AND HEAT-TREATMENT EQUIPMENT IN METALLURGICAL LABORATORY

aluminum alloys also frequently requires long-time heat treatment operations in order to produce structural equilibrium. Smaller furnaces, with accurate temperature control equipment maintaining constant temperatures for periods of several months, are used for these experiments. By a system of compensating thermocouple lead wires, the temperature at any furnace may be accurately ascertained by means of a centrally located precision potentiometer. Aluminum paint on the furnace equipment decreases radiation losses and adds to the lighting efficiency of the laboratory.



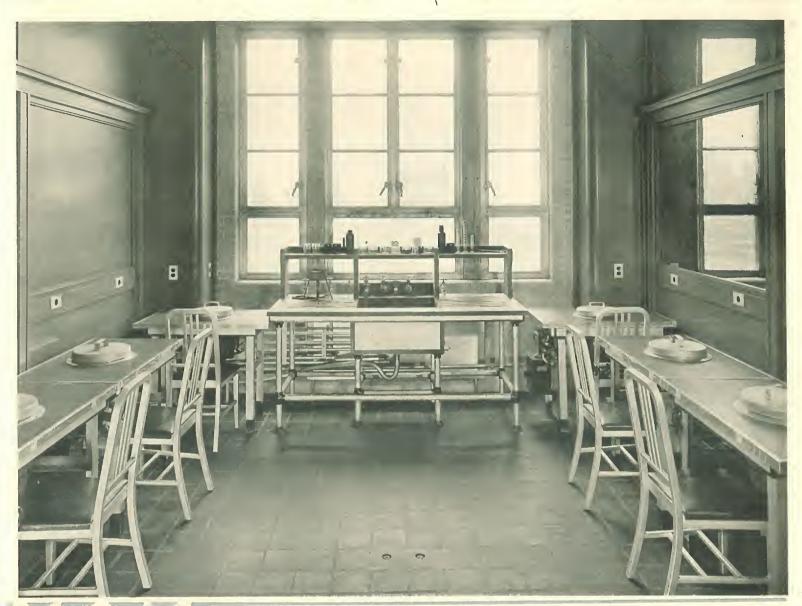


HIGH-FREQENCY INDUCTION FURNACE WITH SMALL MUFFLE FURNACE AT LEFT

FOR the attainment of very high temperatures, a 15 KVA high-frequency induction furnace is available in the Physical Chemistry Laboratory. With this furnace, high temperature experiments can be carried out in vacuo and temperatures as high as 5400° Fahrenheit are readily attainable. The small muffle furnace operates at temperatures up to 2000° Fahrenheit.

Microscopic examination is an important tool of metallurgical research, for while chemical analysis ascertains the total composition of an alloy, the microscope indicates the manner of occurrence of the alloying elements. The

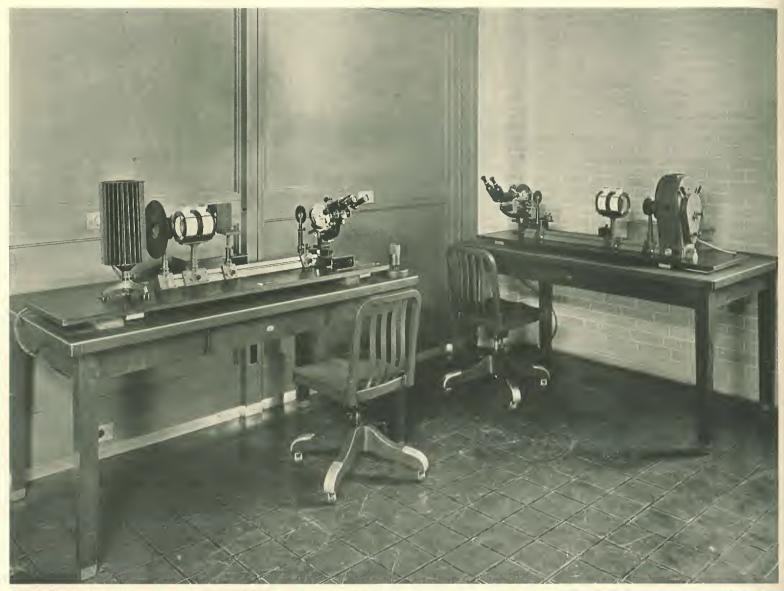
(Page 8)



POLISHING WHEELS FOR PREPARATION OF METALLOGRAPHIC SPECIMENS AND TABLE FOR ETCHING OPERATION

microscope is also important in diagnosing manufacturing troubles and insuring a product free from defects.

The preparation of a metal sample for examination includes a surfacing operation either on emery papers or with a microtome, followed by wet polishing on broadcloth-covered wheels, shown covered in the photograph. The surface of the specimen is generally etched with special solutions to further reveal the structure. Aluminum chairs help make the worker comfortable during the tedious and delicate polishing operation.

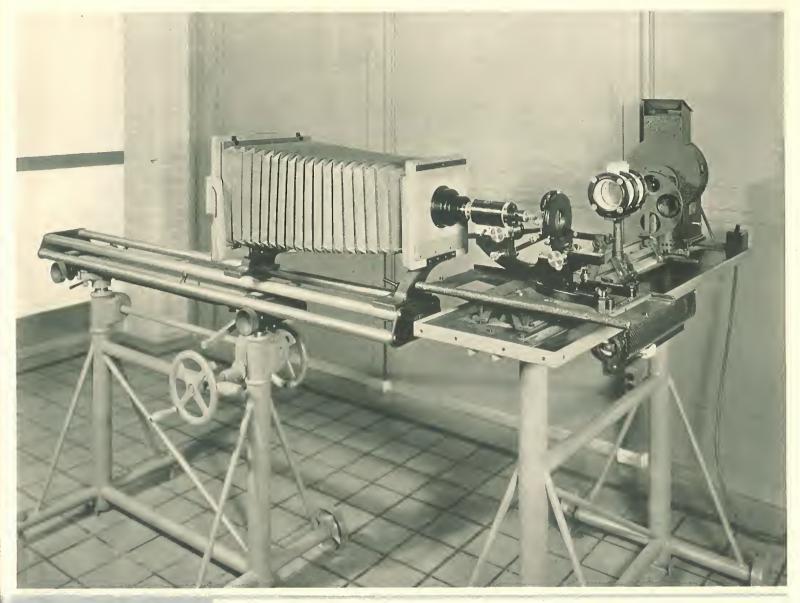


MICROSCOPES FOR VISUAL EXAMINATION OF METAL STRUCTURES

ZEISS MICROSCOPES of the types shown are used for detailed study of specimens, and photomicrographs recording structures of special interest are made on instruments capable of magnifications as low as 5 diameters and as high as 16,000. The motifs for the cover and page decorations in this book are found in the many fantastic structures which the microscope reveals in aluminum and its alloys. The decoration on page 14, for example, is based on a photomicrograph of an aluminum-silicon alloy. On page 15, the design was suggested by an aluminum-copper alloy.



( Page 10 )

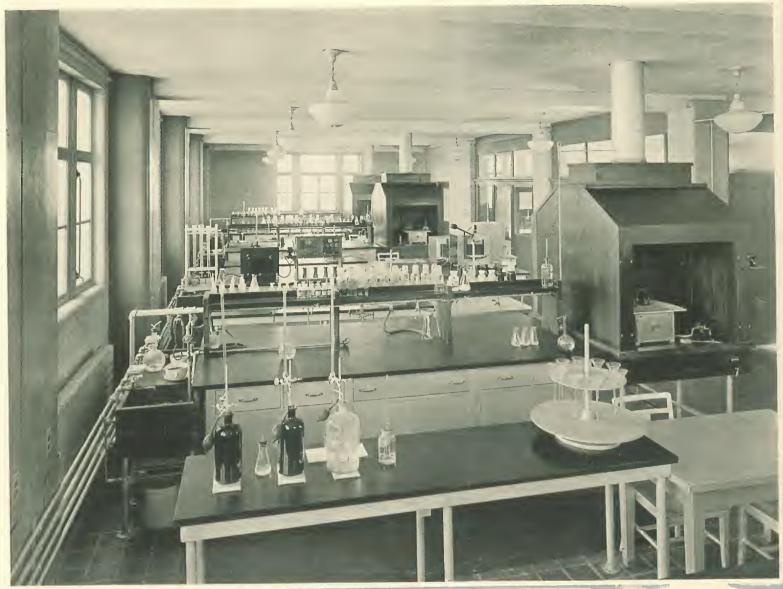


MICROSCOPE FOR THE PHOTOGRAPHY OF METAL STRUCTURES

Two metallurgical laboratories are also equipped for investigating the relative corrosion resistance of aluminum alloys, as well as other metals. A well-equipped welding laboratory is located at the New Kensington plant. Here, electrical welding methods have been developed which greatly increase the ease of fabricating aluminum articles. Spot welding is rapidly replacing riveting for cooking utensils and for many other purposes. Butt and arc welding methods have also been found practical for use with aluminum and its alloys.



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CHEMICAL LABORATORY FOR THE ANALYSIS OF METALS

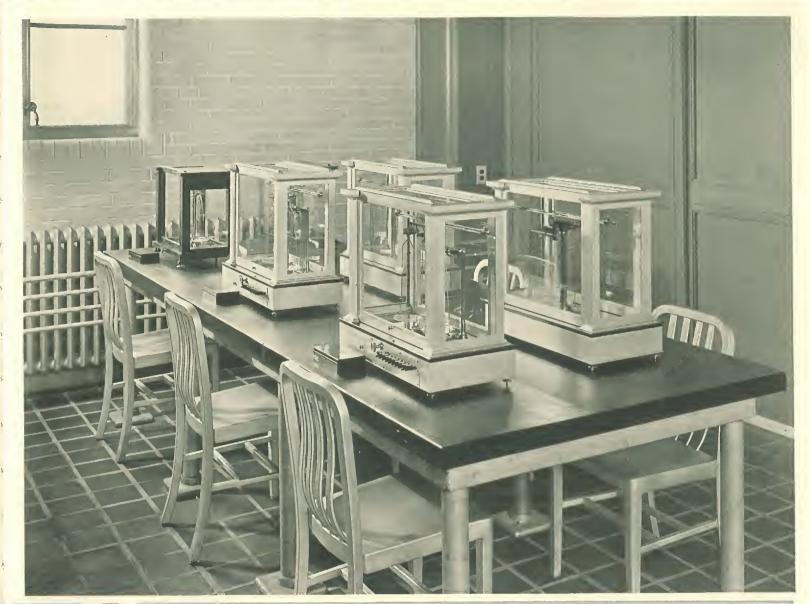
THE determination of the chemical characteristics of materials, including composition, is essential to research. The several laboratories devoted to such work are located on the top floor of the building. Some applications of aluminum in laboratory equipment are here shown as benches, tables, hood supports, filter racks, hotplates, chairs, water-piping, valves and fittings, drawer pulls and hinges. The chemical benches, made of corrosion-resistant aluminum with soapstone tops, are an innovation in laboratory equipment.

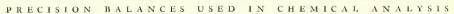
The laboratories are arranged on the unitary basis, giving each chemist

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( Page 12 )



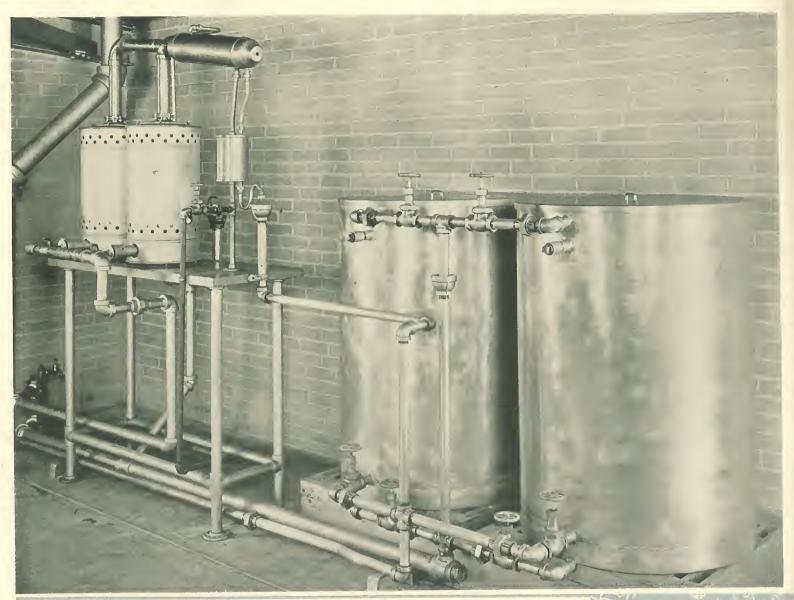




( Page 13 )

for individual use a sink, a work table, a fume hood, a titration table and a writing table. Adequate ventilation, secured by venting but two hoods with a single blower, obviates the necessity of separate balance rooms and permits the use of open alcoves where aluminum-cased keyboard balances are readily accessible.

In these laboratories is done the essential work of establishing and maintaining Alcoa standard analytical methods used in company control laboratories and made available to other laboratories through publication.

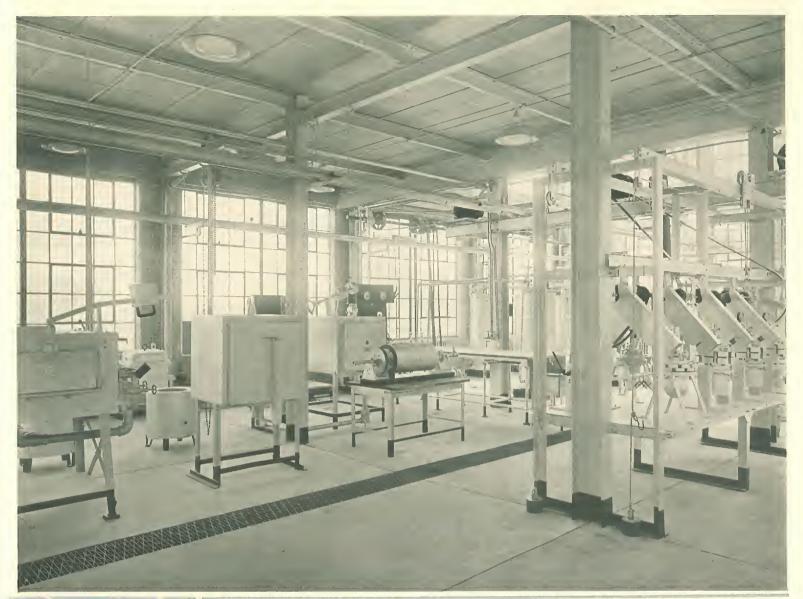


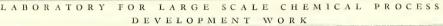
STILL AND ALUMINUM EQUIPMENT FOR STORING AND DISTRIBUTING DISTILLED WATER

THE hot and cold water systems for the entire building are of aluminum pipe, but more interesting and significant is the storage and distribution in aluminum of distilled water so essential to research activities. Two aluminum storage tanks with the essential aluminum piping and fittings are shown near the stills. This installation was based upon twelve years of satisfactory experience in handling distilled water in aluminum.

Chemical process development work is carried out in a large laboratory in the rear court of the building. This laboratory illustrates the advantageous

( Page 14 )





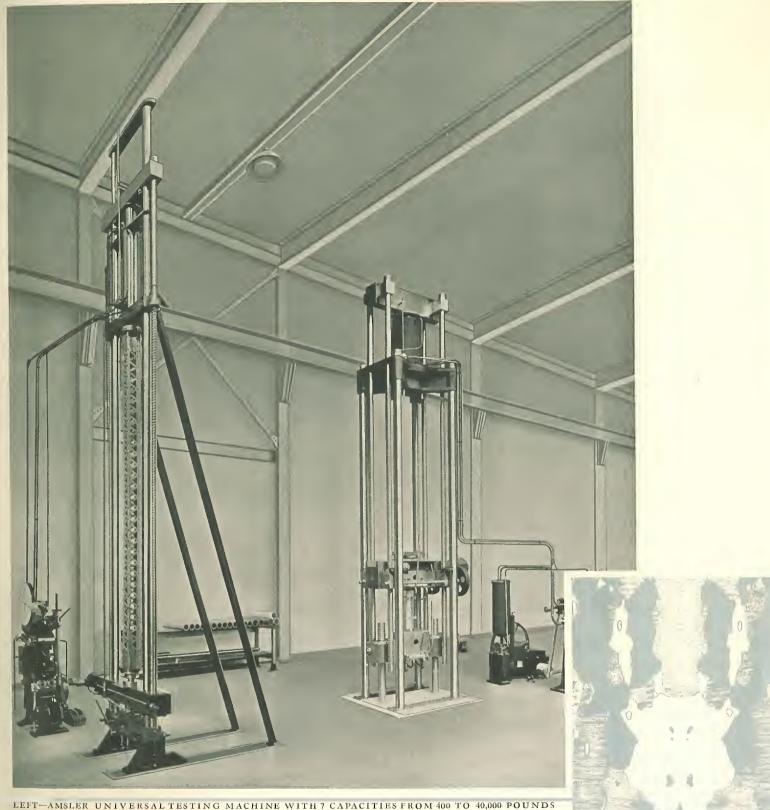


use of aluminum paint to increase lighting efficiency, while simultaneously it protects against corrosive conditions. In these laboratories are a variety of ovens, gas-fired and electrical furnaces; pressure digesters; crushing, grinding and pulverizing machinery; sieves and classifiers. The rear of the laboratory (shown on the next page) is two stories in height, thus permitting the use of full size test units of most plant equipment. The apparatus shown on page 16 is used to measure the moisture absorption efficiency of activated alumina.

( Page 15 )



( Page 16 )

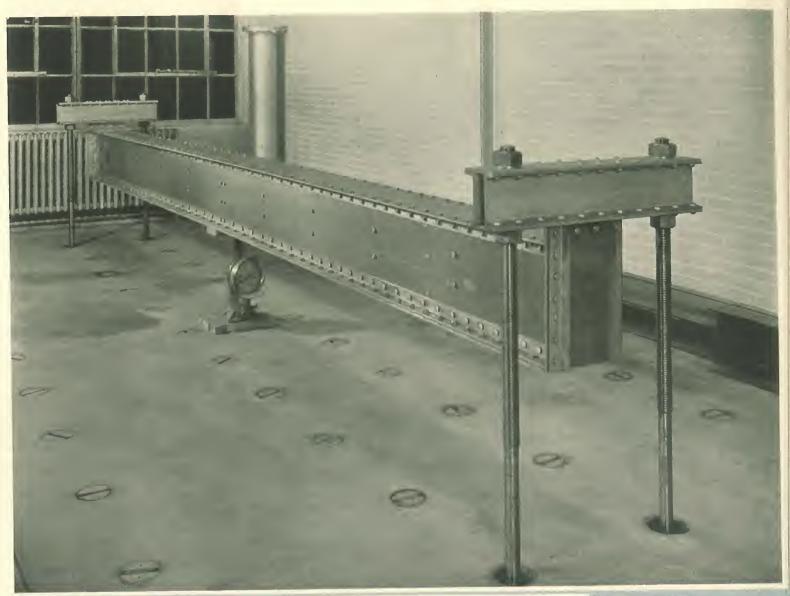


LEFT—AMSLER UNIVERSAL TESTING MACHINE WITH 7 CAPACITIES FROM 400 TO 40,000 POUNDS RIGHT—AMSLER UNIVERSAL TESTING MACHINE WITH 4 CAPACITIES FROM 30,000 TO 300,000 POUNDS

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( Page 17 )



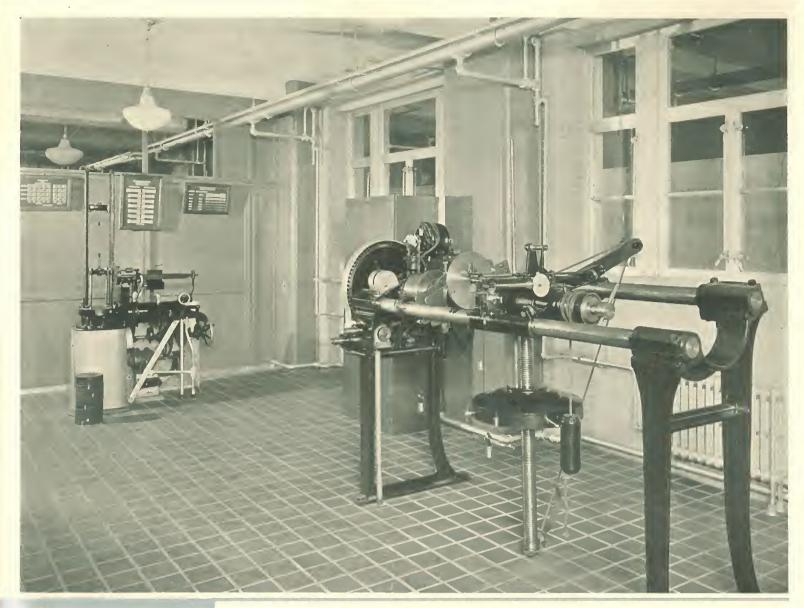
UNIVERSAL FLOOR TEST SLAB; ALUMINUM ALLOY GIRDER IN POSITION FOR TEST WITH 30-TON HYDRAULIC JACK

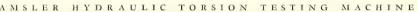
THE LABORATORIES are exceptionally well equipped with testing equipment for the accurate determination of the mechanical properties of metals as well as the strength of fabricated units and structures. The equipment includes a 300,000-lb. Amsler hydraulic testing machine, taking tension or compression specimens up to 10 feet in length, or beams with a maximum span of 10 feet. A somewhat smaller machine has capacities ranging up to 40,000 pounds. These machines are served by a 3-ton aluminum alloy crane.

Adjacent to these large machines is a Universal floor test slab, consisting

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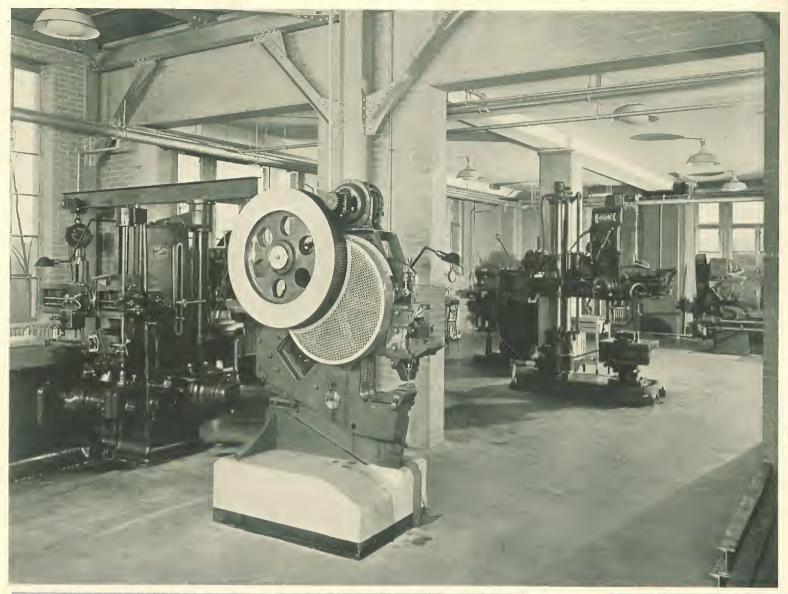


essentially of a reinforced concrete beam 12 feet by 30 feet, the upper surface flush with the floor. In this beam are 48 inserts, each capable of withstanding a pull of 25 tons. By the use of suitable tension bolts and cross members, accurately calibrated hydraulic jacks with capacities up to 75 tons may be used in testing girders, trusses, car frames, truck frames and large machine parts.

The Amsler torsion testing machine has capacities ranging from 240 to 1200 foot-pounds, and handles specimens having a maximum diameter of 3<sup>1</sup>/<sub>4</sub> inches, and lengths up to 4 feet.



( Page 19 )

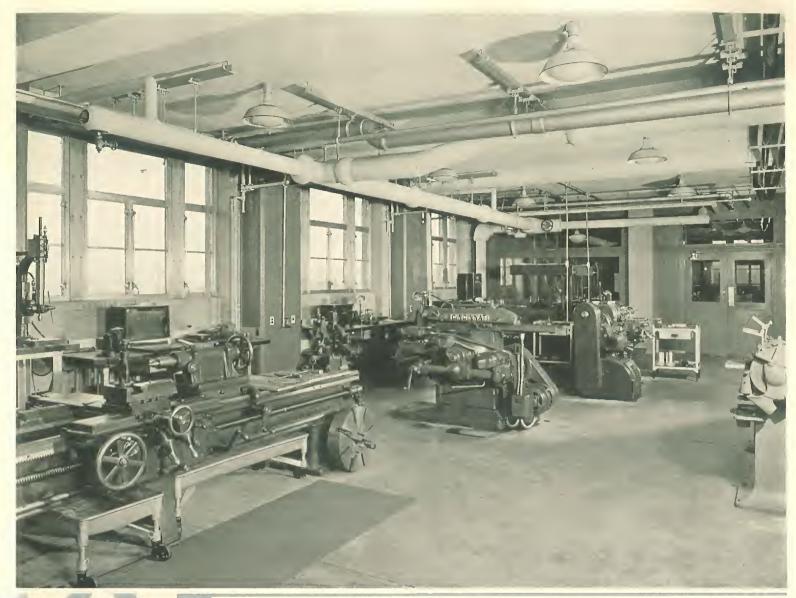


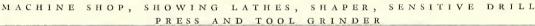
MACHINE SHOP, SHOWING PLANER, UNIVERSAL METAL WORKER, MILLING MACHINE AND RADIAL DRILL PRESS

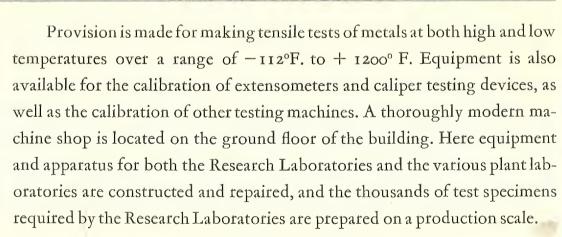
FOR the determination of the tensile and compressive properties of aluminum products, the laboratories are further equipped with smaller Universal testing machines. These machines include two Amsler hydraulic Universal machines, each having seven capacity ranges of 200 to 20,000 pounds, and two Olsen wire testing machines each having capacities of 1,000 and 10,000 pounds. One of the small Amsler machines is equipped with a constant load maintaining device of the hydraulic type, and each is provided with a full set of grips and adapters.

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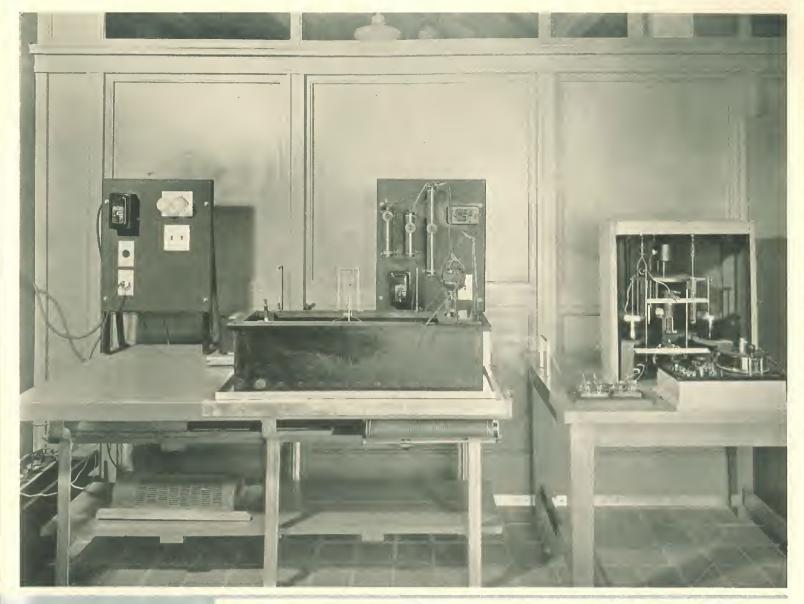


MACHINES FOR MEASURING THE ENDURANCE PROPERTIES OF METALS.

TESTING MACHINES are provided for the determination of the endurance or fatigue properties of metals. This equipment includes 20 R. R. Moore rotating-beam machines, 8 constant deflection-constant stress fatigue machines for testing sheet metal, 4 direct tension fatigue testing machines and 1 cantilever specimen type of machine (patterned after the designs of Prof. H. F. Moore), arranged for testing aluminum tubing and fittings. In the case of aluminum and its alloys, fatigue strengths or endurance limit values are based on the material withstanding 500,000,000 cycles of reversed stress.



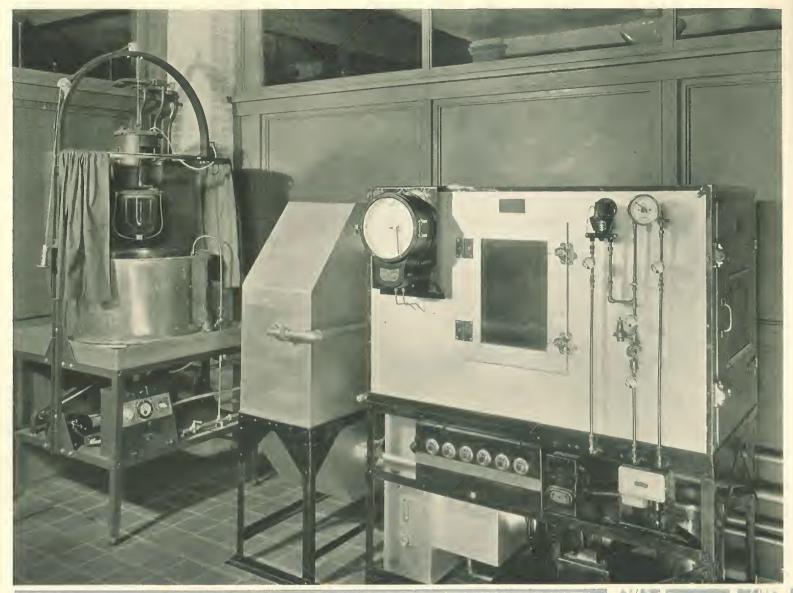
( Page 22 )



PHYSICAL LABORATORY FOR ELECTRICAL MEASUREMENTS

The Physical Chemistry Division is equipped to make precise measurements of such varied properties of materials as conductivity, density of solid and liquid metals, solubility of gases in liquid metals, melting point, density and electrical conductivity of fused salts, etc. The apparatus for the determination of electrical conductivity of solid metals includes a constant-temperature oil bath containing a resistance bridge, a standard resistance, and (at the right) a precision potentiometer and galvanometer with a sensitivity of one hundredth-millionth of a volt.

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ARTIFICIAL WEATHER AND CONSTANT HUMIDITY EQUIPMENT FOR TESTING PAINTS AND LACQUERS

THE Division of Paints and Finishes investigates the properties and application of aluminum paint, as well as the application of paints and finishes to metallic aluminum. For accelerated testing of paints and finishes a special ultra-violet light is used with water spray conveniently attached, so that artificial weather, including sunshine, summer heat, rain, and (in a separate electric refrigerator) winter cold, are available at all times. For determining the moisture-proofing properties of paint coatings, a cabinet with controlled temperature and humidity is employed. On the roof of the laboratories,

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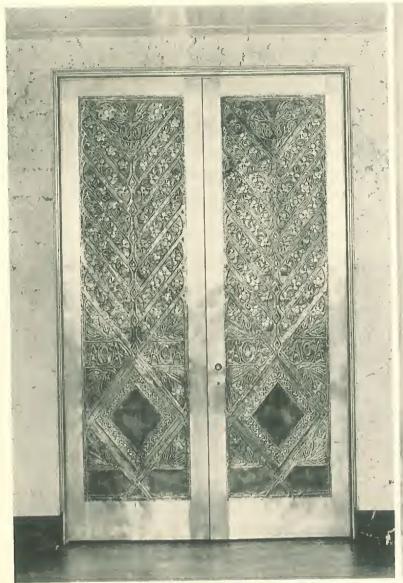
( Page 24 )



RESEARCH LIBRARY

exposure racks provide space for more than 1,000 test panels of wood or metal.

An essential tool for research work is an adequate technical library. The card index in the library now contains some 75,000 cards covering books, scientific and technical articles, and technical correspondence on subjects of interest to the laboratories. In a separate workroom in the library, the Company's technical correspondence is filed according to subject matter. The drawer pulls and trim on metal desks and files are of aluminum.





DETAILS OF HAND-HAMMERED ALUMINUM ELEVATOR
DOORS AND MAIN ENTRANCE DOORS

IT IS but natural that aluminum should be used for many of the decorative and structural features of the laboratories. On axis, facing the front doors in the lobby is a pair of aluminum doors giving entrance to the elevator. The design on these doors is executed in repoussé by hand-hammering of aluminum sheet. Quite naturally, also, the elevator itself is of aluminum alloy construction. Another item of interest in the lobby is the chandelier with cast aluminum decorations.

At either end of the building are stairways with aluminum balustrades

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(LEFT) ALUMINUM STAIRWAY (RIGHT) DETAIL OF SPANDREL (INSERT) DECORATIVE GRILLE

and newel posts and mouldings. The hand-rail is an extruded section welded at the miters and corners at the time of installation, forming a continuous rail. The stair treads are of aluminum with non-skid inserts and the steel substructure of the stairs is finished with aluminum paint to match the aluminum parts of the stairway.

A cafeteria with aluminum tables and chairs for 90 guests is located on the ground floor. Extensive use has been made of aluminum in the kitchen equipment and counters.



(LEFT) METAL DOOR SHOWING ALUMINUM FITTINGS (RIGHT) MAIN LOBBY CHANDELIER (INSERT) ALUMINUM RADIATOR

THE RADIATORS in the offices are covered with an ornamental aluminum casing. The radiator itself consists of a number of horizontal lengths of aluminum tubing to which are tightly fitted a series of vertical aluminum fins which act as flues and permit warm air to circulate upward over the steam-carrying pipes and out into the room. Heating with this type of radiator is rapid and efficient.

The window frames are of heat-treated aluminum alloy, supported by aluminum mullions. The windows are readily adjustable in a number of

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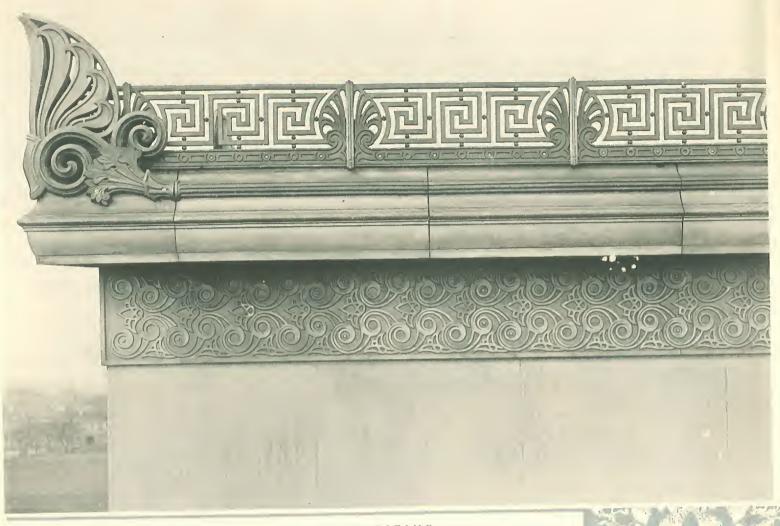




EXTERIOR VIEW OF ALUMINUM WINDOW FRAME AND ALUMINUM MULLIONS

directions, permitting ready ventilation of an office without creating unnecessary drafts. The ornamental aluminum grille shown on page 27 conceals an aluminum radiator. All hardware such as hinges, door checks, door knobs and escutcheons are of aluminum. This hardware has a gray oxide finish with polished highlights. An aluminum mop strip is used with the metal partitions. The lighting fixtures throughout the building have their metal parts of aluminum; the switch plates and electric outlet plates are of the same light metal.

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ALUMINUM CORNICE WITH CRESTING

HERE is shown a close-up view of the cast aluminum cornice and cresting, together with the decorative frieze. It will be noted that the design theme in all decorative features of the building is based on classic Greek forms of geometric ornament, but that these have been tastefully modernized, achieving a happy balance between traditional forms and up-to-the-minute treatment. The castings are made of an aluminum-silicon alloy (No. 43 alloy), which is unusually resistant to weathering.

The laboratory is 275' long with 108' wings at each end. At present it



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REAR VIEW OF ALUMINUM RESEARCH LABORATORIES



contains 56,000 feet of floor space. Although the boilers of the heating system are at present fired with natural gas, arrangements have been made for the ultimate smokeless combustion of bituminous coal. The rear of the building has been left unfinished from the architectural standpoint. As additional space is required for research work, it is intended to complete the building in the form of a hollow square, the present structure being the first unit of the proposed square. The continued rapid growth of the aluminum industry will certainly call for such increased research facilities.

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## ALUMINUM COMPANY OF AMERICA Sales Offices

Albany, N. Y	90 State Street
Atlanta, Ga	1818 Rhodes-Haverty Building
Boston, Mass	20 Providence Street
Buffalo, N. Y	1880 Elmwood Avenue
Chicago, Ili	360 N. Michigan Boulevard
Cincinnati, Ohio	910 Dixie Terminal Building
Cleveland, Ohio	910 Hanna Building
Detroit, Mich	Dunn Road
Indianapolis, Ind714 Merchants National Bank Building	
Kansas City, Mo	804 Land Bank Building
Los Angeles, Calif	S. Broadway
Milwaukee, Wis	425 E. Water Street
Newark, N. J	Academy Building
New York, N. Y	230 Park Avenue
Pittsburgh, Pa	2400 Oliver Building
Philadelphia, Pa2307 Fideli	ty-Philadelphia Trust Building
San Francisco, Calif	Rialto Building
Toledo, Ohio	825 Nicholas Building
St. Louis, Mo	1825 Boatmen's Bank Building
Washington, D. C	606-610 Southern Building

